DMS-4600

Hydraulic Cement

Effective Date: JULY 2020

1. DESCRIPTION

This Specification establishes requirements and test methods for hydraulic cement and the Hydraulic Cement Quality Monitoring Program (HCQMP). Hydraulic cement is cement that sets and hardens by chemical interaction with water and that is capable of doing so under water. (Formerly DMS-4600, "Hydraulic Cement Quality Monitoring Program".)

2. UNITS OF MEASUREMENTS

The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

3. MATERIAL PRODUCER LIST

The Materials and Tests Division (MTD) maintains the Material Producer List (MPL) of all materials conforming to the requirements of this Specification. Materials appearing on the MPL, entitled "Hydraulic Cement," require no further sampling and testing before use, unless deemed necessary by the Project Engineer or MTD.

4. BIDDERS' AND SUPPLIERS' REQUIREMENTS

In most cases, hydraulic cement must be pre-qualified and accepted into the Hydraulic Cement Quality Monitoring Program (HCQMP) in accordance with the requirements listed in Articles 4600.5 and 4600.6 of this Specification.

Use of pre-qualified product does not relieve the Contractor of the responsibility to provide product that meets this Specification. The Department may inspect or test material at any time and reject any material that does not meet the specifications.

In cases when using cement not on the HCQMP for a specific project, the Department will test the cement for compliance with Article 4600.6 of this Specification before allowing the material on the project. Submit two 1 gal. samples, corresponding mill certificates, and Material Safety Data Sheets to the Texas Department of Transportation, Materials and Tests Division, Cement Laboratory (CP51), 9500 North Lake Creek Parkway, Austin, Texas 78717.

Suppliers with multiple products will ensure that the materials in the HCQMP are not contaminated by other approved or non-approved products.

5. PRE-QUALIFICATION PROCEDURE

5.1. **Pre-Qualification Request.** Submit a written request on company letterhead for evaluation under DMS-4600 to DMS_Prequal@txdot.gov.

Include the following information in the request:

- company name;
- physical and mailing addresses of the plant (and the storage facility in Texas for the imports);
- capacity of the storage facilities;
- phone number, and email address of the Quality Control Manager;
- 6 mo. of physical and chemical producer test data meeting Article 4600.6 of this specification;
- information about the laboratory, that the Cement and Concrete Reference Laboratory (CCRL) inspects and, performs all tests required in Article 4600.6; and
- a copy of the producer's Quality Control Program (QCP). General guidelines can be found in AASHTO R38. For the imports, the QCP of the supplier's facility in Texas is also required. At minimum, the QCP shall include:

  - production or distribution facility information including contact information, physical address, storage capacity, photographs of the major areas;
  - QCP roles, responsibilities, training requirements, and certifications;
  - sampling plan
  - current AASHTO accreditation certificate for the laboratory performing the tests in Article 4600.6;
  - hauling handling, and storage processes for imported sources;
  - plan for non-conforming materials;

5.2. **Sampling and Testing.** Sampling will be in accordance with Tex-300-D. Testing will be in accordance with the requirements of Article 4600.6 of this Specification. Sampling is at the mutual convenience of the Department and the supplier.

The Department or a designated Department representative will take pre-qualification samples to place cements on the HCQMP. For cement, not on the HCQMP, the Department will sample the hydraulic cement during the course of a project to ensure continued specification compliance. For cement on the HCQMP or approved for a specific project, producers will submit monthly samples at the beginning of each month for all certified cements. Monthly QM samples should be received by the 15th of each month. The Department reserves the right to conduct random sampling of materials for testing and to perform random audits of test reports.

Department representatives may sample material from the plant, terminal, transportation containers, and concrete plants to verify compliance with Article 4600.6.

5.3. **Evaluation.** MTD will notify prospective bidders and suppliers after completion of material evaluation.

5.3.1. **Qualification.** If approved for use by the Department, MTD will accept the material to the HCQMP and add to the MPL.

Report changes in the composition or in the manufacturing process of any material to MTD. Significant changes reported by the producer, as determined by the Director of MTD, may require a re-evaluation of performance. The Department reserves the right to conduct whatever tests it deems necessary to identify a

pre-qualified material and determine if there is a change in the composition, manufacturing process, or quality that may affect its durability or performance. In case of variance, the Department's tests will govern.

5.3.2. **Failure.** Producers not qualified under this Specification may not furnish materials for use on Department projects.

Producers failing to qualify may submit a request for re-evaluation after 12 mo. have elapsed from the date of the original request. MTD may modify this time limit at its discretion. In the request for re-evaluation, document the cause of the issue and corrective action taken.

The Department normally bears the costs of sampling and testing; however, the producer will bear the costs associated with materials failing to conform to the requirements of this Specification. The Director of MTD will assess this cost at the time of testing, and amounts due will be billed to the producer.

5.4. **Reporting Requirements.** For each type of cement on the HCQMP, submit:

- monthly mill certificate that shows:
  - the cement meets the requirements of this Specification;
  - the minimum, maximum, and average values for equivalent alkalis obtained from quality control tests or a calculated value for maximum total alkali, based on a 95% confidence level; and
  - the average tricalcium aluminate (C_3A) content for Type III(MS) cement meets the requirements of ASTM C150 Table 2;
- for imported foreign cement sources, monthly test report from laboratory, that the Cement and Concrete Reference Laboratory (CCRL) inspects, that shows:
  - the cement meets the requirements of this Specification;
  - the minimum, maximum, and average values for equivalent alkalis obtained from quality control tests; and
  - the average tricalcium aluminate (C_3A) content for Type III(MS) cement meets the requirements of ASTM C150 Table 2;
- written notification of changes in clinker source or other major production changes;
- annual test reports, if applicable, for:
  - ASTM C563;
  - ASTM C1038; and
  - ASTM C265; and
- test reports, if applicable, for processing additions using ASTM C465.

Mill Certificates and monthly test reports will be submitted electronically to the following:

MTD_TxDOTCementMillCerts@txdot.gov

5.5. **Periodic Evaluation.** The Department reserves the right to conduct random sampling and testing of pre-qualified materials to verify performance and Specification compliance and to perform random audits of documentation. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse.

Failure of materials to comply with the requirements of this Specification as a result of periodic evaluation may be cause for removal of those materials from the HCQMP. In case of variance, the Department's tests will govern.

5.6. **Disqualification.** Causes for disqualification and removal from the HCQMP may include, but are not limited to:

- failure to supply cement to any Department project for 1 yr.,
- failure to meet the reporting requirements of the HCQMP,
- failure to supply monthly samples to the department as required by Article 4600.5.2,
- failure of two consecutive samples to meet the material requirements of this Specification,
- failure of the producer or supplier to adhere to its Quality Control Program,
- falsification of documentation,
- producer fails to report any change in material composition or manufacturing process to MTD,
- producer has unpaid charges for failing samples.

MTD will remove disqualified producers from the MPL and will not allow submission of material for re-qualification for up to 12 mo., at the discretion of the Department.

5.7. **Re-Qualification.** Once the disqualification period established by MTD has elapsed, producers disqualified and removed from the HCQMP may begin the re-qualification process by submitting a request in accordance with Section 5.1, including additional documentation identifying the cause of the problem and corrective action taken. The re-qualification process will then follow all subsequent Sections of Article 5.

The Department normally bears the costs of sampling and testing; however, the disqualified producer will bear the costs associated with re-qualification. The Director of MTD will assess this cost at the time of re-evaluation, and amounts due will be billed to the producer.

6. MATERIAL REQUIREMENTS

All types of cement must meet the requirements of ASTM C150 or ASTM C595, with the following additions and exception.

6.1. **Additions to ASTM C150.** ASTM C465 is required when:

- adding 1% to 5% of an inorganic processing addition or an inorganic processing addition, such as fly ash or ground-granulated blast furnace slag. The control cement should be composed of either:
  - clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum, or
  - clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum + limestone (with prior ASTM C465 full or mortar/paste only – fineness tolerances not required); or
- adding 1% to 5% inorganic processing addition AND 1% to 5% limestone addition. The control cement should be composed of clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum.

A modified ASTM C465 including the mortar/paste testing only (fineness tolerances not required) will be required when adding 1% to 5% limestone to a cement already containing an inorganic processing addition (with prior passing ASTM C465). The control cement should be composed of either:

- clinker + organic grinding aid (with prior passing ASTM C465) + gypsum, or
- clinker + organic grinding aid (with prior passing ASTM C465) + gypsum + inorganic processing addition (with prior passing ASTM C465 submitted before the effective date of this Specification).

For cements with limestone additions, report a corrected percent limestone to accurately reflect the total amount of limestone added. Report the difference between background/baseline loss on ignition (pre-limestone addition) and the total loss on ignition (after limestone addition) as the corrected percent limestone.

6.2. **Additions to ASTM C595.**

6.2.1. **Type IP.** Type IP portland-pozzolan cements must be blended with at least the minimum percentage of fly ash listed in the Fly Ash MPL. Use of lower percentages of fly ash will be allowed if ASTM C1567 test data is provided showing the proposed percentage of fly ash will limit the expansion to a <0.10% when tested using a fine aggregates with an ASTM C1260 ≥0.30%. Laboratory performing ASTM C 1567 must be listed on the Department's list of Commercial Laboratories Certified for ASTM C 1260/1567 Test Methods.

6.2.2. **Type IIIP.** Type IIIP portland-pozzolan cements must meet all the requirements of a Type IP, and the strength requirements listed in Table 1.

Table 1
Compressive Strength Requirements for Type IIIP Cements

Item	Limit, Min psi
1-day compressive strength	1,890
3-day compressive strength	3,780

6.2.3. **Type IS.** Type IS portland blast-furnace slag cements must be Type IS (>35).

6.2.4. **Type IT.** Type IT ternary blended cements must contain 35% to 50% supplementary cementing materials, and no more than 35% may be fly ash, and no more than 10% may be silica fume. Type IT cements containing less than 35% supplementary cementing materials, or contained limestone as one of the constituents, must provide ASTM C1567 test data showing the proposed Type IT cement will limit the expansion to a <0.10% when tested using a fine aggregates with an ASTM C 1260 ≥0.30%.

Note: When performing ASTM C1567 using Type IP or Type IT cements, use the proposed blended cement, and do not replace any of the proposed blended cement with additional supplementary materials.

7. ARCHIVED VERSIONS

Archived versions are available.